STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

DIVISION OF THE
STATE GEOLOGICAL SURVEY
FRANK W. DeWOLF, Chief

Cooperative Mining Series
BULLETIN 23

MINES PRODUCING LOW-SULPHUR COAL IN THE CENTRAL DISTRICT

BY
GILBERT H. CADY

ILLINOIS MINING INVESTIGATIONS
Prepared under a cooperative agreement between the Illinois State Geological Survey Division, the Engineering Experiment Station of the University of Illinois, and the U. S. Bureau of Mines

PRINTED BY AUTHORITY OF THE STATE OF ILLINOIS

URBANA, ILLINOIS
1919

ILLINOIS MINING INVESTIGATIONS

Cooperative Agreement

GAS SECTION

The difficulty, due to war conditions, of obtaining adequate and reliable delivery of eastern gas-coal and of coke has suggested the wider use in gas manufacture of low-sulphur coal mined in the central district, comprising Illinois, Indiana, and western Kentucky.

The needs of the gas industry, and the desire of the U. S. Fuel Administration to meet those needs, has led to the appointment by Governor Frank O. Lowden, of a Technical Committee on Gas, By-products, and Public Utilities, to act in an advisory relation. The committee includes representatives of the Illinois Gas Association, the U. S. Bureau of Mines, the Engineering Experiment Station of the University of Illinois, and the State Geological Survey Division of the Department of Registration and Education, State of Illinois.

Previously, some studies of the use of Illinois coal in retort-gas manufacture and in by-product coke ovens, and of the chemical and physical properties of Illinois coal, have been conducted under the Illinois Mining Investigations, cooperative agreement—a joint agency of the U. S. Bureau of Mines, the University of Illinois, and the State Geological Survey Division. The continuation and expansion of this work has been recommended by the Technical Committee and the Fuel Administration. In response a Gas Section has been created, and experienced gas engineers, chemists, and other specialists have undertaken a program of experiment on a commercial scale to extend the use of central district coal in water-gas generators and in gas retorts.

The results of the investigations will be published, and, in addition, the operators of gas plants in the region naturally tributary to central district coal will be advised by the Technical Committee, of time to time, and will be urged to witness and par-ts and to introduce in their own plants new or s which will lessen the burden on the railroads, es and the coke ovens to meet the unprecedented e war.

suggestions regarding the gas experiments should as Section, Room 305, Ceramics Building, Urbana,

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CONTENTS

TABLES

MINES PRODUCING LOW-SULPHUR COAL IN THE CENTRAL DISTRICT

By Gilbert H. Cady

LOW-SULPHUR COAL IN CITY-GAS MANUFACTURE

The sulphur content of a coal is a conditioning factor that has an important bearing on its use in the manufacture of water-gas and retort coal-gas. This is especially true in the case of coals from Illinois, Indiana, and western Kentucky, as most of the coals from these three fields have a sulphur content that renders them unsuitable for gas manufacture with the purifying facilities now installed. In fact, certain gas manufacturers are inclined to the opinion that none of the coals from these fields has a sufficiently low sulphur content to make it suitable for the manufacture of city gas. However, it has been pointed out in two earlier bulletins of this series [1] that some of these coals have been giving satisfactory results in the manufacture both of retort coal-gas and of water-gas in operating plants. Furthermore, later experimental use of several of the low-sulphur central district coals under the direction of Mr. Odell and Mr. Dunkley has also demonstrated the practical possibility of their substitution for coke in the manufacture of water-gas. Some of the results of these experiments will soon be placed before the public.

Between some of the Illinois, Indiana, and western Kentucky coals and the eastern gas coals there is actually very little difference in sulphur content. Inspection of the analyses given in the following table will show that this is the case.

[1] Dunkley, W. A., and Odell, W. W., The manufacture of retort coal-gas in the central states using low-sulphur coal from Illinois, Indiana, and western Kentucky: Illinois Mining Investigations Bull. 21, 1918.

Odell, W. W., and Dunkley, W. A., Water-gas manufacture with central district bituminous coals as generator fuel: Illinois Mining Investigations Bull. 22,

TABLE 1.—*Analyses of eastern gas coals and of low-sulphur coals from Illinois, Indiana and western Kentucky*
(As received basis)

Source of sample	Lab. No.	Kind of sample[1]	Moisture	Volatile matter	Fixed carbon	Ash	Sulphur	Hydrogen	Carbon	Nitrogen	Oxygen	B. t. u.	U. S. Bureau of Mines	
													Bull.	*Page*
KENTUCKY					**Eastern Gas-Coals**									
Letcher Co	14905	F	3.64	35.81	57.96	2.59	.51	5.39	80.06	1.52	9.93	14,242	85	39
Harlan Co	24728	F	2.02	39.25	55.63	3.10	.78	.....	.....	.....	.....	14,375	123	43
Harlan Co	24732	F (composite)	3.56	37.18	56.55	2.71	.70	5.54	79.61	1.61	9.83	14,220	123	43
PENNSYLVANIA														
Westmoreland Co	2187	C (lump)	3.15	30.27	56.17	10.41	1.26	4.96	74.33	1.43	7.61	13,406	22	183
VIRGINIA														
Wise Co	18229	F (composite)	2.29	32.87	59.62	5.22	.54	5.18	80.78	1.57	6.71	14,420	123	115
WEST VIRGINIA														
Logan Co	7658	F	1.60	33.70	57.86	6.84	1.27	5.11	76.65	1.26	8.87	13,918	22	247
Marion Co. (Fairmount field)	1213	C (run of mine)	1.75	36.77	55.14	6.34	.90	5.28	78.00	1.54	7.94	14,107	22	273
Marion Co. (Fairmount field)	7586	F	3.13	32.96	56.41	7.50	.90	5.35	74.99	1.49	9.77	13,505	22	273
ILLINOIS					**Illinois Low-Sulphur Coals**									
Franklin Co	22691	F (composite)	9.19	33.80	48.61	8.40	.92	5.49	67.25	1.52	16.42	11,925	123	33
Franklin Co	23444	F (composite)	9.93	33.13	48.77	8.17	.75	5.46	67.08	1.41	17.13	11,896	123	33
Franklin Co	20726	F (composite)	8.87	32.72	49.05	9.36	.94	5.05	66.81	1.52	16.32	11,785	123	33
Williamson Co	1820	C (lump and egg)	8.43	30.08	51.89	9.60	1.14	5.18	67.33	1.50	15.25	11,959	22	92
INDIANA					**Indiana Low-Sulphur Coal**									
Sullivan Co	10960	F	13.05	34.30	47.61	5.04	.82	6.07	67.34	1.44	19.29	12,022	85	37
KENTUCKY					**Kentucky Low-Sulphur Coal**									
Webster Co	19153	F	5.80	33.42	52.04	8.74	1.13	.....	.....	.....	.....	12,600	123	53

[1] F means face sample; C means car sample.

LOW-SULPHUR COAL IN ILLINOIS, INDIANA, AND WESTERN KENTUCKY

In view of the probability that gas manufacturers in the central district may desire to make experimental runs with coal from this district, especially as the results of the present investigations are announced from time to time, it is thought desirable to present a list of mines from which coal having less than 1.25 per cent of sulphur may be obtained. The list as prepared indicates sources of low-sulphur coal which probably can be used either in generators or in retorts. It should be borne in mind, however, that the amount of sulphur liberated from the coal is different under the two operations. Much is yet to be learned in regard to the behavior of the different varieties of sulphur in coal under the influence of heat and under working conditions both in the water-gas and in the retort-gas plant. It is believed, however, that many plants can take care of sulphur produced by central district coals having a sulphur content of less than 1.25 per cent.

The list is presented with some reservations. In the first place the determination of the sulphur content is based largely upon the analysis of face samples. In taking such samples, the sampler, as is generally known, rejects all impurities more than ¼ to ⅜ inch in thickness, and care is taken that fragments of the roof, floor, or clay bands are not included in the sample. Accordingly a face sample commonly shows better coal than is usually mined from the same face. However, comparisons of analyses of face and car samples from Illinois mines in the low-sulphur district show very little difference, and not always to the advantage of the face sample. So that while it is well to point out the nature of the evidence, apparently no great allowance needs to be made for the fact that the data are largely based upon the analyses of face samples.

The following table gives the data in regard to the comparative value for sulphur content, as based upon the analyses of face and car samples of several Illinois coals.

TABLE 2.—*Sulphur content of several Illinois coals, as determined by analyses of face and of car samples*

	Per cent of sulphur	
	Face sample	Car sample [1]
	0.62	0.59
	1.13	1.23
	0.83	1.14
	0.77	0.84
	1.07	1.06
	1.03	1.45
	0.85	0.89
Average	0.90	1.03

[1] Coal of various sizes.

A second conditioning factor affecting the value of the list exists in the fact that the sulphur values upon which the list is based include all sulphur present and do not distinguish between the different varieties of sulphur known to exist in coal. It has been shown that sulphur exists in coal in three forms: as sulphur in combination with iron, that is, as iron pyrite; as sulphate sulphur, or gypsum; and as organic sulphur in at least two forms. It has not been demonstrated to what extent each of these forms of sulphur contributes to the total sulphur content of the gas made in a gas retort or in a generator. It seems probable, however, that the sulphur occurring as sulphate is retained in the ash and coke in retort coal gas operation, so that it becomes of importance to know how much of the sulphur in the coal is in the form of a sulphate. Unfortunately these data are not available. Consequently, it is possible that the yield of sulphur in gas from the coals listed may not be in simple relation to the total amount of sulphur present as determined by analysis of the coal.

A third reservation to be considered is the incompleteness of the data. It is probable that not all the mines producing low-sulphur coal within the limit assigned are included in the list. This is especially true for Indiana and Kentucky. In the case of Illinois it is believed that the mines producing low-sulphur coal have all been listed with six possible exceptions, not including new mines not yet in operation at Valier, West Frankfort, Zeigler, and Dowell. Of these six exceptions, only one, Mine "B" of the Chicago, Wilmington and Franklin Coal Company, lies well within the area where the low-sulphur coal is found. It is very probable that the coal supplied by this mine is also low-sulphur coal. The other five mines lie near the border of the area of low-sulphur coal, and it is not safe to predict whether they properly belong within or without the area. The most promising area of low-sulphur coal in Illinois includes parts of Franklin, Williamson, Jackson, and Perry counties, and is rather definitely outlined because the sulphur content shows a remarkable increase across a very narrow boundary, so that certain mines can be placed very definitely within the area of low-sulphur coal, and closely adjacent mines are as definitely without the area. Accordingly, it is not safe to judge the character of the coal from a mine lying near the boundary merely from the location of the mine. Although uncertainty exists as to the quality of the coal from these five mines, it is thought wise to list these mines as possible sources of low-sulphur coal, with the understanding that analytical information in regard to the sulphur content is not available.

List of mines lying near the boundary of the area of low-sulphur coal, which are possible sources of low-sulphur coal, but for which no analytical data are available

Operator's name and address	Mine	Address of mine
Franklin Coal & Coke Co. 332 S. Michigan Ave., Chicago.	Mine No. 2 (South)	Royalton
Johnston City Coal Co. 116 S. Michigan Ave., Chicago.	Mine No. 2	Johnston City
Ernest Coal Co. Johnston City, Ill.	Ernest	Johnston City
T. G. Warden Coal Co. Fisher Bldg., Chicago.	Mine No. 1	Herrin
Taylor Coal Co. Old Colony Bldg., Chicago.	Energy No. 2	Herrin
Taylor Coal Co. Old Colony Bldg., Chicago.	Energy No. 1	Herrin
Modern Coal Co. Old Colony Bldg., Chicago.	Mine No. 1	Sesser

Finally, it has been thought advisable to present the information without giving the actual averages for the sulphur content from individual mines and without thereby assuming to grade the coals. A considerable number of the analyses were made from samples collected by the Bureau of Mines. Some of these data have been published previously, and a separate list is included herewith, indicating the exact sources of the information. Other analyses were made for the State Geological Survey, and because it would be contrary to the policy of the State Survey to reveal detailed analyses or averages from individual mines, it has been necessary to supply the list without the detailed analytical data which might make it considerably more useful. However, all the mines listed furnish coal the analyses of which, based upon two to fifteen face or car samples, show an average sulphur content less than 1.25 per cent. The range in the average sulphur content of the different coals is from 0.62 to 1.14 per cent; the range in sulphur content of the individual analyses is from 0.51 to 2.11 per cent. Information in regard to the analysis of coal sampled at individual mines for the State Survey, has been furnished to the operator of each mine previously and it can be obtained from the Survey, provided the request is accompanied by the written consent of the operators concerned.

In presenting the following list, the Survey does not guarantee that the coals furnished by the mines listed will in all cases prove acceptable. Other factors bearing on the manufacture of gas affect the acceptability of a coal to nearly as great a degree as the sulphur content. The present investigations have not been carried sufficiently far for an adequate understanding of all the other factors, so that they do not enter into consideration in the preparation of the present list. The list is presented with the expectation that it will be of assistance to gas manufacturers in the selection of those coals which, because of their low-sulphur content, have at least that much in their favor as gas coal, or as a substitute for coke in water-gas manufacture.

TABLE 3.—*List of mines in Illinois, Indiana, and western Kentucky,*

Operator and main office	Mine	Address of mine	County
Illinois			
Bell & Zoller Mining Co..... 343 S. Dearborn St., Chicago.	Zeigler No. 1	Zeigler	Franklin
Big Muddy Coal & Iron Co..... Wainwright Bldg., St. Louis.	No. 7 No. 9	Herrin Murphysboro	Williamson Jackson
By-Products Coke Corporation.. 332 S. Michigan Ave., Chicago.	No. 19	West Frankfort	Franklin
Chicago, Wilmington & Franklin Coal Co. ..... McCormick Bldg., Chicago.	Orient "A"	Orient Duquoin	Franklin Williamson
Equitable Coal & Coke Co..... Duquoin, Ill.	Majestic	Herrin	Perry
Franklin Coal & Coke Co..... 332 S. Michigan Ave., Chicago.	North No. 1	Royalton	Franklin
Gus Blair Big Muddy Coal Co.. 1003Boatmens Bank Bldg., St. Louis.	No. 2	Murphysboro	Jackson
Hafer Washed Coal Co..... 332 S. Michigan Ave., Chicago.	No. 3	Carterville	Williamson
Madison Coal Corporation..... 1114 Karpen Bldg., Chicago.	No. 9	Dewmaine	Williamson
Old Ben Coal Corporation..... McCormick Bldg., Chicago.	No. 8 No. 10 No. 11 No. 12 No. 14	West Frankfort Christopher Christopher Christopher Buckner	Franklin Franklin Franklin Franklin Franklin
Paradise Coal Co..... Duquoin, Ill.	Paradise	Duquoin	Perry
Pond Creek Coal Co..... Herrin, Ill.	Pond Creek	Herrin	Williamson
W. P. Rend Coal & Coke Co.... McCormick Bldg., Chicago.	No. 2	Herrin	Williamson
Sesser Coal Co..... Old Colony Bldg., Chicago.	Sesser	Sesser	Franklin
Taylor Coal Co..... Old Colony Bldg., Chicago.	No. 5 (Possum Ridge)	Herrin	Franklin
West Frankfort Coal Co..... West Frankfort, Ill.	West No. 1	West Frankfort	Franklin
Indiana			
Calora Coal Co..... Terre Haute, Ind.	Calora No. 1	Jasonville	Greene
Clinton Coal Co..... Clinton, Ind.	Clinton No. 4	Clinton	Vermilion
United Fourth Vein Coal Co.... Indianapolis, Ind.	Black Creek	Linton	Greene
Vandalia Coal Co..... Terre Haute, Ind.	Gilmour No. 7 No. 10 Vandalia No. 28 Ayrdale	Jasonville Dugger Cass Dugger	Greene Sullivan Sullivan Sullivan
Kentucky			
West Kentucky Coal Co..... Sturgis, Ky.	No. 7	Clay	Webster

[1] From statistics in the Thirty-sixth Annual Coal Report of Illinois (1917), Department of Mines and Minerals.

probably capable of producing coal with less than 1.25 per cent sulphur

Railroads	Production 1917 [1]	Supplied to railroads [1]	Number of samples averaged	
			Face samples	Car samples
	Short tons	*Per cent*		
C. B. & Q.; I. C.; Mo. P.	1,065,359	1	13	11
C. B. & Q.; I. C.; Mo. P.	481,278	15	8	2
I. C.; Mo. P.	246,465	0	5	...
I. C.; C. & E. I.	269,641	0	8	...
C. B. & Q.; I. C.; C. & E. I.	1,008,474	6	2	2
C. B. & Q.; I. C.; Mo. P.	522,373	17	3	
I. C.	599,540	35	6	...
C. B. & Q.; I. C.; Mo. P.	555,505	0	9	1
Mo. P.	65,423	0	3	...
I. C.; Mo. P.	223,721	0	3	...
I. C.	564,954	97	2	...
C. B. & Q.; I. C.; C. & E. I.	1,093,317	12	3	...
C. B. & Q.	656,261	24	8	...
C. B. & Q.	869,504	17	4	...
C. B. & Q.; I. C.	641,427	10	8	...
C. B. & Q.; I. C.	891,882	7	5	...
I. C.	483,483	15	6	...
C. B. & Q.; I. C.	226,882	5	4	...
C. B. & Q.; I. C.	702,304	9	8	...
C. B. & Q.	509,324	29	7	2
C. B. & Q.; I. C.	267,177	0	4	...
C. B. & Q.; I. C.; C. & E. I.	624,714	9	6	1
C. T. H. &. S. E.	170,000	...	1	...
C. & E. I.	.....	...	4	...
C. T. H. &. S. E.	.....	...	2	1
C. T. H. & S. E.; C. I. & L.	.....	...	4	...
Vandalia	.....	...	9	...
C. T. H. & S. E.; C. I. & L.	.....	...	3	...
C. T. H. & S. E.; C. I. & L.	.....	...	4	...
L. & N. ;I. C.	414,790	...	6 (1914) 4 (1918)	...

TABLE 4.—*Source of the analytical data concerning the sulphur content of central district coals*

Company	Mine	Kind of sample	State Geological Survey[1]				U. S. Bureau of Mines			U. S. Geological Survey Bulletin
			Published		Unpublished					
			Bull. 29[2]	Bull. 16	U. of I.[3]	B. of M.[4]	Bull. 22	Bull. 85	Bull. 123	
							Page	*Page*	*Page*	*Page*
Bell & Zoller Mining Co	No. 1	F	X	X	X	.....	84–5	.....	.....	.....
		C	.....	.....	.....	.....	84	.....	.....	Bull. 332; p. 85
Big Muddy Coal & Iron Co	No. 7	F	.....	X	X	.....	92	.....	.....	.....
		C	.....	.....	.....	.....	92	.....	.....	.....
do	No. 9	F	X	X	.....	.....	.....	.....	.....	.....
By-Products Coke Corporation	No. 19	F	X	X	.....	.....	.....	.....	.....	Unpublished
Chicago, Wilmington & Franklin Coal Co	Orient	F	.....	.....	.....	.....	.....	.....	33	.....
		C	.....	.....	.....	X	.....	.....	.....	.....
do	"A"	F	X	.....	.....	.....	92	.....	.....	.....
Clinton Coal Co	Clinton No. 4	F	.....	.....	.....	X	.....	.....	.....	.....
Equitable Coal & Coke Co	Majestic	F	.....	.....	.....	.....	.....	.....	35	.....
Franklin Coal & Coke Co	North No. 1	F	X	.....	.....	.....	.....	.....	33	.....
		F	.....	.....	.....	X	.....	.....	.....	.....
Gus Blair Big Muddy Coal Co	No. 2	F	X	.....	.....	.....	.....	.....	.....	.....
Hafer Washed Coal Co	No. 3	F	X	.....	.....	.....	.....	.....	.....	.....
Madison Coal Corporation	No. 9	F	.....	.....	X	.....	.....	.....	.....	.....
Old Ben Coal Corporation	No. 10	F	.....	.....	.....	X	.....	.....	.....	.....
do	No. 11	F	.....	.....	.....	X	.....	.....	.....	.....
do	No. 12	F	X	.....	.....	.....	.....	.....	33	.....
do	No. 14	F	.....	.....	.....	.....	.....	.....	33	.....
Paradise Coal Co	Paradise	F	X	.....	.....	.....	.....	.....	.....	.....
Pond Creek Coal Co	Pond Creek	F	.....	.....	.....	X	.....	.....	.....	.....
Sesser Coal Co	Sesser	F	X	X	X	.....	83	.....	.....	.....
		C	.....	.....	X	X	83	.....	.....	.....
W. P. Rend Coal & Coke Co	No. 2	F	.....	.....	.....	X	.....	.....	.....	.....
Taylor Coal Co	Possum Ridge	F	.....	.....	.....	X	.....	.....	.....	.....
West Frankfort Coal Co	West No. 1	F	.....	.....	X	.....	.....	.....	33–34	.....
		C	.....	.....	.....	.....	.....	.....	.....	Bull. 290; p. 66

INDIANA										
Calora Coal Co	No. 1	F	.....	.....	.....	X	.....	.....	.....	.....
United Fourth Vein Coal Co	Black Creek	F	.....	.....	.....	.....	53	.....	.....	.....
		C	.....	.....	.....	.....	93	.....	.....	.....
Vandalia Coal Co	Gilmour No. 7	F	.....	.....	.....	X	.....	.....	.....	.....
	No. 10	F	.....	.....	.....	.....	.....	37	.....	.....
	Vandalia No. 28	F	.....	.....	.....	X	.....	.....	.....	.....
	Ayrdale	F	.....	.....	.....	X	.....	.....	.....	.....
KENTUCKY										
West Kentucky Coal Co	No. 7	F (1914)	.....	.....	.....	.....	.....	.....	53	.....
		F (1918)	.....	.....	.....	X	.....	.....	.....	.....

[1] Identity of analyses determined for the State Geological Survey revealed only upon a request accompanied by written consent of operators concerned.
[2] Analyses in Bull. 29 are duplicated in Coal Mining Investigations Bull. 3.
[3] Analyzed in laboratory of University of Illinois.
[4] Analyzed in laboratory of U. S. Bureau of Mines.

The preceding tabulation shows the source of analytical data used in preparing the list of mines producing low-sulphur coal.

In addition to the coals above listed, there are a few others which are reported to be used by some gas companies of this region. No analyses of these coals are now available, but the indication, from results obtained with them, is that they come within the sulphur limits prescribed in Table 3. Some of these coals have been used mixed with other coals, and therefore the results to be attributed to the individual coals are uncertain. Two coals, namely fourth vein coal from Clinton, Indiana, sold by the J. K. Dering Coal Company, McCormick Building, Chicago, and the Wheatcroft coal, mined by the Western Kentucky Coal Company of Sturgis, Kentucky, have been used alone and apparently with success. The former coal is used successfully by at least two gas companies as water-gas generator fuel, while the latter has been used by at least two Illinois gas companies for coal-gas manufacture.

PUBLICATIONS OF ILLINOIS MINING INVESTIGATIONS.[1]

ILLINOIS STATE GEOLOGICAL SURVEY DIVISION
URBANA, ILLINOIS

Bulletin 1. Preliminary report on organization and method of investigations, 1913.
Bulletin 3. Chemical study of Illinois coals, by S. W. Parr, 1916.
Bulletin 10. Coal resources of District I (Longwall), by G. H. Cady, 1915.
Bulletin 11. Coal resources of District VII, by Fred H. Kay, 1915.
Bulletin 14. Coal resources of District VIII (Danville), by Fred H. Kay and K. D. White, 1915.
Bulletin 15. Coal resources of District VI, by G. H. Cady, 1916.
Bulletin 16. Coal resources of District II (Jackson Co.), by G. H. Cady, 1917.
Bulletin 17. Surface subsidence in Illinois resulting from coal mining, by Lewis E. Young, 1916.
Bulletin 18. Tests on clay materials available in Illinois coal mines, by R. T. Stull and R. K. Hursh, 1917.
Bulletin 20. Carbonization of Illinois coals in inclined gas retorts, by F. K. Ovitz, 1918.
Bulletin 21. The manufacture of retort coal-gas in the central states, using low-sulphur coal from Illinois, Indiana, and western Kentucky, by W. A. Dunkley, and W. W. Odell, 1918.
Bulletin 22. Water-gas manufacture with central district bituminous coals as generator fuel, by W. W. Odell and W. A. Dunkley, 1918.
Bulletin 23. Mines producing low-sulphur coal in the central district, by G. H. Cady, 1919.

ENGINEERING EXPERIMENT STATION
URBANA, ILLINOIS

Bulletin 2. Coal mining practice in District VIII (Danville), by S. O. Andros, 1913.
Bulletin 4. Coal mining practice in District VII, by S. O. Andros, 1914.
Bulletin 5. Coal mining practice in District I (Longwall), by S. O. Andros, 1914.
Bulletin 6. Coal mining practice in District V, by S. O. Andros, 1914.
Bulletin 7. Coal mining practice in District II, by S. O. Andros, 1914.
Bulletin 8. Coal mining practice in District VI, by S. O. Andros, 1914.
Bulletin 9. Coal mining practice in District III, by S. O. Andros, 1915.
Bulletin 12. Coal mining practice in District IV, by S. O. Andros, 1915.
Bulletin 13. Coal mining in Illinois, by S. O. Andros, 1915. (Complete resumé of all the district reports.)
Bulletin 91. Subsidence resulting from mining, by L. E. Young and H. H. Stoek, 1916.
Bulletin 100. Percentage of extraction of bituminous coal with special reference to Illinois conditions, by C. M. Young, 1917.

U. S. BUREAU OF MINES
WASHINGTON, D, C.

Bulletin 72. Occurrence of explosive gases in coal mines, by N. H. Darton, 1915.
Bulletin 83. The humidity of mine air, by R. Y. Williams, 1914.
Bulletin 99. Mine ventilation stoppings, by R. Y. Williams, 1915.
Bulletin 102. The inflammability of Illinos coal dusts, by J. K. Clement and L. A. Scholl, Jr., 1916.
Bulletin 137. Use of permissible explosives in the coal mines of Illinois, by J. R. Fleming and J. W. Koster, 1917.
Bulletin 138. Coking of Illinois coals, by F. K. Ovitz, 1917.
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[1] Bulletins listed in italics apply directly to the problem of use of central district bituminous coals in place of eastern coal and coke.